



Modular Manipulator for Robotics Applications



Developer: ARM Automation
Contract Number: DE-AR26-98FT40371
Crosscutting Area: Robotics

**Deactivation &
Decommissioning**
FOCUS AREA

Problem:

The Department of Energy (DOE) has distinct needs to process and/or clean up incredible volumes of hazardous materials throughout multiple sites and facilities. It has been determined that these difficult and dangerous materials must be handled using automation for reasons of safety, speed, consistency and net cost. Given the number of complex tasks such as Contaminated Automated Analysis (CAA), Automated Plutonium Processing (APP), and Deactivation and Decommissioning (D&D), several different robotic systems must be deployed to address the unique needs of each operation.

Existing "one-off" robotic technology does not offer viable solutions to these needs because each system is slow and expensive to develop, deploy, and maintain. Moreover, traditional robotic solutions, with their low payload to weight ratios, proprietary system controls, massive wiring, small work volumes, and high integration costs, offer little in the way of customizability for meeting the DOE's specific task needs.

This project focuses on the needs of APP tasks which involve the manipulation of plutonium containers and the transfer of their contents. Specific challenges of APP gloveboxes include restrictive entry ports, confined workspace, limited maintenance access and destructive plutonium particulates which make this task virtually impossible to automate with existing technology.

Solution:

In order for automation systems to be successful within DOE facilities, they must provide maximum

functionality, flexibility, ease of use and reliability, while facilitating the rapid deployment of each custom system. This work concentrates on in-depth design and deployment of self-contained actuator modules which shall be used to construct a robotic manipulator tailored for APP tasks. A human scale manipulator will be built from two sizes of DISCActuator[®] and will replace existing human labor within plutonium gloveboxes. The modular nature of ARM Automation's technology readily enables installation and maintenance of automation within "hot" boxes.



Benefits:

- ▶ Quickly deployable
- ▶ Simple maintenance & repair
- ▶ Simplified, open-architecture, PC-based system control
- ▶ Modular reconfigurability
- ▶ Small umbilical (1/10th size)
- ▶ Easily customized geometry
- ▶ High payload to weight ratio
- ▶ Easily integrated into existing APP glove box operations
- ▶ Lower life cycle cost (4 to 7X)

Technology:

The proposed family of modular actuators, with their DISC[®] (Distributed Intelligent Servo Control) electronics and the associated links and yokes, provides a set of tools from which an almost limitless variety of automated machines can be created on demand. Each actuator module contains sensors, DISC[®] control electronics, motor, bearings, geartrain and mechanical interfaces. With the addition of low cost links, yokes, an open-architecture PC-based system controller, and unified operational

software, this spectrum of actuators can be integrated into a completely functional robotic manipulator system. The use of DISC[®] technology provides embedded intelligence and the capacity for true "plug-and-play" operation. The open-architecture on which this system is based eliminates proprietary interfaces and communications which serve to limit the capability and flexibility of automation equipment. Additionally, operational software developed by UT Austin utilizes the open, modular architecture of ARM's technology to greatly enhance the capabilities of conventional robotic control systems.

Contacts:

This project represents a joint effort between ARM Automation, Inc. and The University of Texas at Austin. Both organizations have long been proponents of modular robotic technology and key personnel have extensive knowledge and experience in integrating complex automation technologies into functional systems.

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